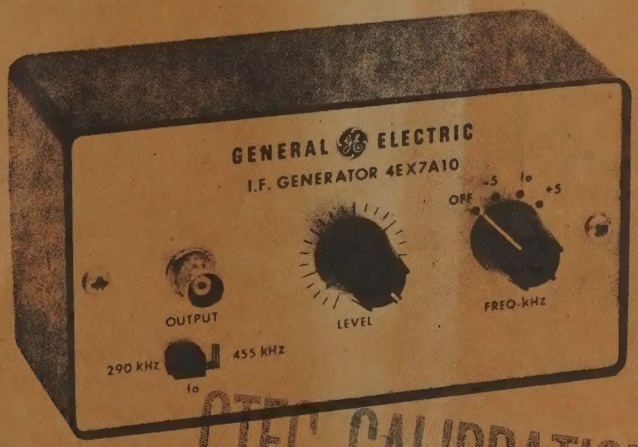
MOBILE RADIO

WORK SHOP

MAINTENANCE MANUAL

IF Generator MODEL 4EX7A10

MARINE AERADIO STATION
MAR 24 1972
CHURCHILL, MANITOBA



GTEC CALIBRATION CENTER

SPECIFICATIONS *

Combination Number (includes Test Set and Cable)	TE41
Dimensions (H x W x D)	3" x 5-1/2" x 2-1/2"
Input Power	3 milliamps at 7 volts (one 7-volt mercury battery).
Output Voltage	0 to 0.1-volts RMS
Output Frequencies Available (if appropriate crystals are ordered)	285 kHz 290 kHz 295 kHz 450 kHz 455 kHz 460 kHz
Temperature Range	0°C to 45°C (+32°F to 113°F)

Approx 54.00

*ese specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

DESCRIPTION

General Electric Test Set Model 4EX7A10 is a transistorized, battery-operated IF Generator designed for alignment of IF and discriminator circuits in two-way FM receivers.

The generator uses a crystal-controlled oscillator to provide outputs of 285 kHz, 290 kHz, 295 kHz, 450 kHz, 455 kHz, and 460 kHz when the appropriate crystals are installed. Six internally mounted crystal sockets facilitate crystal installation.

All controls and output connections are conveniently located on the front of the IF Generator. Output frequencies are selected by a two-position slide switch and a four-position rotary switch. Slide switch S1002 (fo) selects the center output frequency (290 kHz or 455 kHz) while rotary switch S1001 (FREQ-kHz) permits selection of frequencies 5 kilohertz above and below the selected center frequency. (The rotary switch also turns the generator on). The LEVEL control adjusts the signal level that is available at the OUTPUT jack to any desired level between 0 and 0.1 volts.

A four-foot cable is supplied for making connections between the generator and the unit under test.

OPERATION

To use the test set for receiver alignment, refer to the receiver instruction manual for the Lo IF frequency and complete alignment procedure. Operate the IF Generator as follows:

1. Make connections (with 4-foot cable supplied) between the test set and receiver Lo IF input.

2. Select the desired output frequency (290 kHz or 455 kHz) with slide switch.

3. Set FREQ-kHz switch to F_o position to turn unit on and obtain 290-kHz or 455-kHz output.

4. Adjust LEVEL control for desired output.

5. Select output frequencies of 5 kilocycles below and 5 kilohertz above the f_o frequency (290 kHz or 455 kHz) with the -5 and +5 positions, respectively, on the FREQ-kHz switch as required by receiver alignment procedure.

NOTE

If the receiver discriminator adjustment procedure specifies signals 10 kHz above and below IF frequency, tune discriminator for 1/2 of the recommended output voltage when applying signals 5 kHz above and below IF frequency.

CIRCUIT ANALYSIS

Output frequencies are generated by a battery-operated, crystal-controlled, Colpitts oscillator (Q1 & Q2). Q1 and Q2 are compound-connected to provide necessary drive to the crystal. The desired frequency is obtained by switching the crystals in the oscillator control circuit.

Selecting a frequency with the FREQ-kHz switch, connects positive battery voltage to the collectors of Q1 and Q2 through R2. Positive base bias is established by R1, causing Q2 and Q1 to conduct. As current flows in the collector circuit of the transistors, regenerative feedback is provided to the crystal controlled base circuit to sustain oscillation at the crystal frequency.

LEVEL control R1001 adjusts the output signal level present at OUTPUT jack J1001.

MAINTENANCE

BATTERY REPLACEMENT

To replace battery, take out the two screws holding the front plate and carefully remove the housing. Then remove the old battery and insert the new battery (Eveready No. E165 or equivalent) being certain to maintain the same polarity.

WARNING

Do not dispose of mercury batteries by burning them, since they may explode.

TROUBLESHOOTING PROCEDURE

Troubleshooting procedures are outlined in the following chart. Also refer to voltage and resistance readings on the Outline and Schematic Diagrams.

TROUBLESHOOTING PROCEDURE CHART	
SYMPTOM	CHECK THE FOLLOWING
NO OUTPUT	1. Battery. 2. S1001 and S1002. 3. Q1 and Q2.
EXCESSIVE CURRENT DRAIN ON BATTERY	Q1 and Q2 for shorts.
CANNOT ADJUST OUTPUT	R1001
WILL NOT OPERATE ON ONE FREQUENCY, BUT OTHER FREQUENCIES OK.	1. S1001 and S1002. 2. Associated crystal and crystal socket.

PARTS LIST

LBI-3797B

IF GENERATOR TEST SET
MODEL 4EX7A10 19C311195-G1

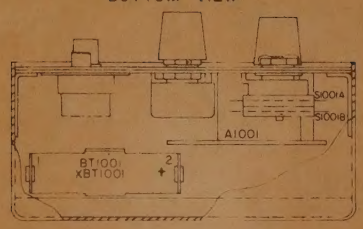
SYMBOL	G-E PART NO.	DESCRIPTION
A1001		COMPONENT BOARD 19B205639-G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C3	7489162-P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 and Q2	19A115889-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P474K	Composition: 0.47 megohms ±10%, 1/2 w.
R2	3R77-P182K	Composition: 1800 ohms ±10%, 1/2 w.
R3*	3R77-P392K	Composition: 3900 ohms ±10%, 1/2 w. In Rev. A and earlier:
	3R77-P512K	Composition: 5100 ohms ±10%, 1/2 w.
R4	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R5*	3R77-P561J	Composition: 560 ohms ±5%, 1/2 w. Added by Rev. B.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1 thru Y6	19B200360-P3	285.000 KHz.
	P4	290.000 KHz.
	P5	295.000 KHz.
	P9	450.000 KHz.
	P10	455.000 KHz.
	P11	460.000 KHz.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1 thru XY6		(See Miscellaneous).
		- - - - - - - - - - BATTERIES - - - - - - - - - -
BT1001	5492174-P1	Mercury: 7 v; sim to Mallory Type TR-165.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1001	5496218-P46	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C1002*	19B209243-P15	Polyester: 0.22 µf ±20%, 250 VDCW. Added by Rev A.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1001	7776570-P17	Receptacle, bulkhead: coaxial, 500 v peak. Military Type UG-1094/U.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1001	5496870-P19	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(5K).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1001	19C307060-P4	Rotary: 2 section, 4 position, 6 poles; sim to CTS 222-17254-2.
S1002	7145098-P1	Slide: DPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole SS-150.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7487424-P22	Miniature, phen: 1 terminal.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XBT101	19B200019-P4	Retainer, battery; sim to Keystone Electronics 110.
		CABLE ASSEMBLY 19B205457-G2
	19B209044-P4	Cable, RF: 48 in; sim to Amphenol 21-199.
	7776570-P1	Connector, BNC: Plug; sim to Military UG-88C/U or UG-88D/U.
	4033711-P1	Clip, alligator. (Used with center lead and shield).
	19A115821-P1	Sleeving, insulated: Red; sim to Mueller Electric 32B. (Used with center lead).
	19A115821-P2	Sleeving, insulated: Black; sim to Mueller Electric 32B. (Used with shield).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	7142162-P81	Spacer: (Located between housing and A101 Board).
	4039182-G2	Knob: (For R1001 and S1001).
	19A115793-P1	Contact, electrical: sim to Malco 2700. (Part of XY1 thru XY6).
	4033089-P1	Clip. (Part of XY1 thru XY6).
	19C311172-P1	Socket. (Part of XY1 thru XY6).

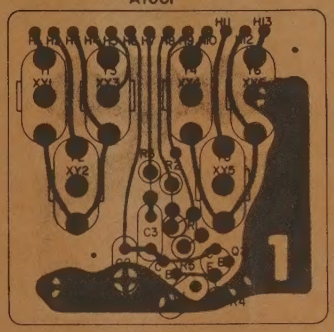
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

OUTLINE DIAGRAM

BOTTOM VIEW



A1001



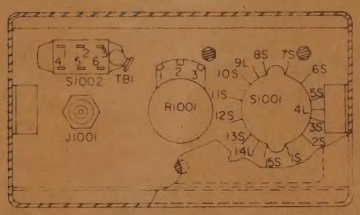
RESISTANCE READINGS
(S1001 IN THE OFF POSITION)

TRANSISTOR	E		B		C	
	−	+	−	+	−	+
Q1	0	0	15K	15K	20K	2.9K
Q2	20K	2.9K	15K	15K	100K	12K

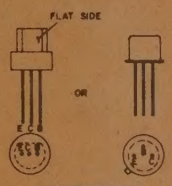
ALL READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR PINS TO GROUND. + OR − SIGN SHOWS METER PROBE GROUNDED. READINGS ARE TAKEN WITH THE BATTERY REMOVED AND A JUMPER BETWEEN XBT1001 1 AND -2.

CAUTION
REMOVE THE JUMPER BETWEEN XBT1001-1 AND -2 BEFORE REPLACING BATTERY

REAR VIEW



FLAT SIDE



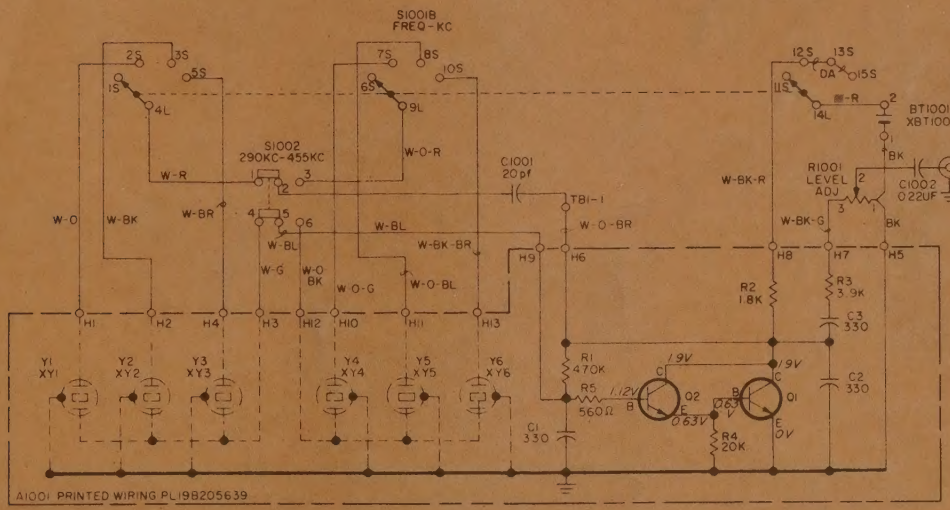
LEAD IDENTIFICATION
FOR Q1 & Q2

XTAL	FREQ
Y1	285 KC
Y2	290 KC
Y3	295 KC
Y4	450 KC
Y5	455 KC
Y6	460 KC

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

(19C311317, Rev. 1)
(19B205658, Sh. 1, Rev. 1)
(19B205658, Sh. 2, Rev. 1)

SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EX7A10	B

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

NOTES
1 ALL WIRES ARE N24 UNLESS OTHERWISE SPECIFIED

VOLTAGE READINGS

READINGS MADE WITH 20,000 OHM-PER-VOLT METER, MEASURED TO BATTERY NEGATIVE.

(19C311192, Rev. 4)

OUTLINE & SCHEMATIC DIAGRAM

IF GENERATOR MODEL 4EX7A10

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revisions stamped on the unit inculdes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To provide DC blocking capacitor. Added C1002.

REV. B - To stabilize the oscillator. Changed R3 and added R5.